November 10, 1999

Public Utilities Commission of the State of California
Room 5016
505 VanNess Avenue
San Francisco, CA 94102

Attn: Administrative Law Judge Patricia A. Bennett

Subj: Investigation 99-07-001 for the Purpose of
Establishing a Priority List for Crossings to be Eliminated or Altered

Ref: Comments: Railroad Grade Crossing Project Investigation 99-07-001
By R.M. Barton October 22, 1999

The Honorable Patricia A. Bennett

The reference "comments" by Mr. R. M. Barton were received and reviewed. Mr. Barton points out that the currently used formula for priority ranking has certain short comings. This writer agrees that there are shortcomings and that some modifications to the formula would better reflect the economic and accident potential at a crossing.

The currently used formulas are:

I. To Eliminate Existing and Proposed Crossing

$$P = \frac{V(T+0.1xLRT)}{CxF} \qquad (AH+BD)+SCF$$

Where:

P	=	Priority Index Number
V	=	Average 24-hour Vehicular Volume
C	-	Total Separation Project Costs (in Thousands of Dollars)
T	-	Average 24-Hour Train Volume
LRT	=	Average 24-Hour Light Rail Train Volume

F	=	Cost Inflation Factor (based on Current Construction Cost Index) = 8.39
AH	=	Accident History
BD	=	Crossing Blocking Delay
SCF	=	Summation of Special Conditions Factors = VS+RS+CG+PT+OF (Vehicular Speed Limit, Railroad Prevailing Maximum Speed, Crossing Geometrics, Alternate Route Availability, Number Passenger Trains, and Other Factors - i.e., secondary accidents, emergency vehicle usage, passenger buses, school buses, hazardous materials on trains and trucks, and community impact.

II. To Alter, Widen or Reconstruct Existing Railroad Separation

$$P = \frac{V(T+0.1xLRT)}{CxF} + SF$$

Where:

P	-	Priority Index Number
V	=	Average 24-hour Vehicular Volume
T	=	Average 24-Hour Train Volume
LRT	=	Average 24-Hour Light Rail Train Volume
C	=	Total Separation Project Costs (in Thousands of Dollars)
F	=	Cost Inflation Factor (based on Current Construction Cost Index) = 8.39
SF	=	Separation Factors = WC + HC + SR + AS + POF + AP + DE (Width Clearance, Height Clearance, Speed Reduction, Accidents at or near structure, Probability of Failure, Accident Potential, Delay Effects)

Review of Formula I; to Eliminate Existing and Proposed Crossing

The $\frac{V(T + 0.1\ LRT)}{CF}$ is what represents a cost benefit factor and traffic "Conflict" factor in the formula. This factor is multiplied by the Accident Factor (AH) and Blocking Delay Factor (BD). The accident factor, of course, allows for specific considerations of crossings where there have been significant accidents. This allows for the "after the fact case", with the emphasis being on crossing where significant <u>accidents</u> have <u>occurred</u>. However, the use of a 10 year accident history may not be consistent with the potential for accident risk. As an example if 10 people were killed at a crossing 11 years ago, we are saying that now, there is no longer the same potential for accidents at the crossing since it is now more than 10 years. It would appear that a judgmental factor needs to be applied by the examiners in order to determine if the potential has changed. It is suggested that this factor be modified to account for accidents over a longer period. Possibly a weighted number for 5-year increments over a 15 year or 20 year period to allow for a more gradual change in the accident factor.

I agree with Mr. Barton that this factor should more properly be placed with Special Condition Factors (SCF) as an additional factor.

In this manner the staff can fully evaluate the accidents as they relate to alternate crossings, grades and vehicle - train volumes. This would allow for low volume traffic where accidents occur versus high volume crossings that have a low number of accidents. The understanding of the multiplying term of AH instead of an additional term is to take into effect the volume at a crossing. As pointed Out volume does not necessarily provide an indication of accident potential. By using this factor as a SCF accidents can be taken into consideration without affecting the cost-benefit factor.

The second multiplier to the cost benefit factor is the blocking delay factor, (BD). This factor reflects the potential at a particular crossing for accidents and indirectly the lost time and dollars to the public associated with the blocked crossing.

The representation of the V x T x BD as a measure of the lost time and dollars for at-grade crossings is noted on Attachment A, ~ Approximation of Yearly Costs of AT Grade Railroad Highway Crossings".

There is some inconsistency in the blocking delay in that a train that blocks the crossing 20 minutes has the same significance as 20 trains blocking the crossing 1 minute each. This does not necessarily reflect the accident potential due to the number of trains crossing. If the total blocking delay time is to be considered, as suggested by Mr. Barton, it is basically reflected in the formula presently used, since the average blocking delay multiplied by the number of trains is the total blocking time.

There could be some significance in considering blocking delay as it occurs relative to peak vehicular traffic. This may or may not reflect on accident potential, but it does have a direct bearing on public delay and associated costs. This probably is another complication in the formula, but with the normal traffic counts data the train-vehicle conflict versus time could be determined. In this manner this would provide a better measure of vehicle delay.

The formula as presently used reduces the effect of LRT's by a multiplier of 10%. Previous testimony has indicated significant difference in the stopping distance of LRT versus heavy trains which is some measure of accident potential. This reduction should stay in the present formula. However, it does not provide a true measure of the <u>total</u> blocking delay if LRT's are involved. To truly measure the lost time at a crossing the total trains would be more representative. However, if the total blocking delay is incorporated as suggested, there is again an advantage for LRT crossings versus heavy trains since they will directly add to the blocking delay.

This writer believes that for the purposes of comparing heavy trains, the present cost-benefit formula with the BD multiplier and the reduced LRT is a purposeful representation of cost benefit, delay cost to the public, vehicle and train conflict.

Review of Formula II; to Alter, Widen or Reconstruct Existing Railroad Separations

The present formula has a "benefit-cost" factor which incorporates the train volume. Mr. Barton contends that this factor should be removed from the formula and replaced with a constant.

The train volume factor being included reflects that this is a railroad separation and provides a measure to assess the significance of the separation relative to others. This also provides a means, although not directly, for comparison with the proposed at-grade crossings to be separated which are competing for the same funds.

If the accident factor is removed from Formula I as a multiplier, the values of the benefit-cost factors in the two formulas are more closely aligned helping to decrease the differences in the two priority numbers.

This category of projects are already separated, but may be deficient in roadway geometrics or possibly structural adequacy. The fact that these projects are separated eliminates the train vehicle conflict, with the need being based on deficiency in roadway geometrics or structural adequacy. It appears that there are adequate provisions in the Separation Factors to evaluate these potentials. There maybe a need in some cases to consider alternate crossings and the impacts to be considered if the crossing was closed or non-operable.

Grade Separations to Replace Proposed Grade Crossings

This writer agrees with Mr. Barton that this category is normally at the "bottom" of the priority list and that it does not take into consideration the cost, vehicle counts and train counts.

One of the concerns in including vehicle counts is that they are "projections" which are subjective as to how much traffic will be diverted. Whereas, the existing crossings data are based on traffic [4~]counts" which are assumed to be less subjective.

This writer believes that the intent of the legislative acts in regards to relative prioritizing of proposed crossings needs to be carefully reviewed before the present formula is modified.

State of Readiness

The state of readiness has always been of concern. Some projects have taken two years to obtaining C&M Agreements even though they were high on the priority list, therefore they could not file for funding with Caltrans. In some cases, plans must be substantially prepared prior to obtain railroad approval of the agreements. The state of readiness in this case should not distract from the priority ranking. Projects that are determined, to be in high priority based on the general formula should not have their position "changed" due to state of readiness of other projects.

This state of readiness credit can put a considerate burden on the smaller entities that cannot afford to prepare plans and obtain right-of-way before funding. To consider the state of readiness in the formula could provide a big advantage for the larger entities that have funds available to prepare plans and obtain right-of-way.

In regards to projects that are considerably into the design process and ready for advertising, there are presently provisions to go ahead with the process and still be considered in the priority list and be funded in accordance with their priority numbers on the list in later years.

Recommended Formula Revisions

Projects to Eliminate Existing or Proposed Crossings

1. Multiply LRT movements x 0.1 as presently in the formula.

2. Revise the Accident History (AH) to be a Special Conditions Factor. Reconsider the 10 year cut-off date for accidents. Possibly use a longer period with weighted 5 year increments.

3. The Blocking Delay (BD) should be a multiplier to the benefit-cost factor. Possibly consider blocking delay as related to the number of vehicles blocked when considering total time blocked at a crossing.

4. The "State of Readiness" should not be considered in the formula. The recommended formula:

$$P = \frac{V \text{ x } (T \quad +0.1\ LRT)}{CxF}\ (BD) + \text{Special Condition Factors}$$

Special Condition factors include the presently used factors plus the Accident History (AH) as an additional factor.

Projects to Alter or Reconstruct Existing Separation

1. Multiply train movements x 0.1 as presently used in the formula.

2. Consider adding a factor for alternate crossing.

3. The "State of Readiness" should not be considered in the formula. The proposed formula:

$$P = \frac{V \times (T \quad +0.1\ LRT)}{CxF} + \text{Separation Factors}$$

The Separation Factors would be the same as in the present formula with a possible alternate crossing factor to be added.

It would appear that a hearing or workshop could be useful to consider the formula revisions.

Very truly yours,

MOFFATT & NICHOL ENGINEERS

H. Richard Neill

HRN/pjs
Bennett/lm12
Enclosure: Attachment A
P.U.C. (L.A.) Jim Esparanza

A 1st APPROXIMATION OF YEARLY COSTS OF
AT-GRADE RAILROAD-HIGHWAY CROSSING
GRADE SEPARATION AND PROJECT COST JUSTIFICATION

Prepared by H. Richard Neill
Senior Engineer – Moffatt & Nichol Engineers

It is possible to approximate the costs to the motoring public due to the delays at a crossing when the crossing protection is activated.

In developing this approximation:

T	-	Average Daily Train Traffic
V	=	Average Daily Vehicle Traffic
TR	-	Average Daily Truck (Commercial) Traffic
BD	-	Average Blocking Delay Time at a Crossing for a Train Movement. (Minutes)

If vehicle delay is 15 seconds longer than blocking delay time.

Total Crossing Closure "C" $\frac{BD}{60} \times T$ hours/day

Average Hourly Vehicles Delayed $\frac{V}{24}$ Vehicles/hour

Average Vehicles Delayed = VD = $\left[\frac{BD + .25}{60}\right] \times T \times \frac{V}{24}$ = Vehicles/day

Lost Time = VD x Lost Time/Vehicle = VD x $\frac{[BD + .251}{60}$

Lost Time Per Day = $\left[\frac{BD + .251}{3600}\right.^2 \times T \times \frac{V}{24}$ = Vehicle-hours/day

Lost Time Per year = $\frac{[ILD]^2}{3600} \times \frac{T \times V \times 365}{24} = \frac{[BD+.25]^2}{3600} \times T \times \frac{V}{24} \times 365$

For Simplicity if BD = 1 minute then

Lost Time $[l.25]^2 \times \underline{T \times V \times 365} = \underline{[l.25]2xTxVx\ 365}$

3600 24 3600 24

If cars are assumed to be 90% of traffic and trucks (TR) are assumed to be 10% of traffic and in addition, if vehicle costs are assumed at:

Car @ $.30/mile	= $9.00/hr.	Truck $10.00/hr.
Driver costs	= <u>$6.00/hr.</u>	Driver <u>$15.00/hr.</u>
$15.00/hr	$25.00/hr	

Total Costs per Year = [.9 x 15.00 + .10 x $25.00] x V x 365] x 1.5625 3600 24
Total Costs per year = [13.5 + 2.5] x 365 [T x V] x 1.5625
3600 24

Total Costs per Year can be Approximated by <u>2.5 x T x V</u> or Generalized by
<u>l.6 x T x V x</u> [BD+.25]2 24
24

If we assume a 40-year life of a Grade Separation Project, the lost time benefits could support a grade separation project approaching 40 times the average yearly costs.

As examples		Justifiable Grade Separation
If T = 20	V=15,000	
Yearly costs	$31,250	$1,250,000
If T = 50	V = 40,000	
Yearly costs	$208,333	$8,333,000
If T = 60	V = 60,000	
Yearly costs	$375,000	$15,000,000

These supported costs are independent of accident potential, accident history and other justification. It provides a simple cost benefit approach based on a cost benefit analysis.

Using this approach, an index of costs to benefits can be used as an additional evaluation criteria.

This also can give an indication as to when traffic increases may justify construction of a separated crossing.

When separated grades appear warranted a detailed value analysis is also warranted

A Graph of this approximation for various daily vehicles volumes follows.

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